Broadband, absolute radiometer arrays for Earth radiation imaging

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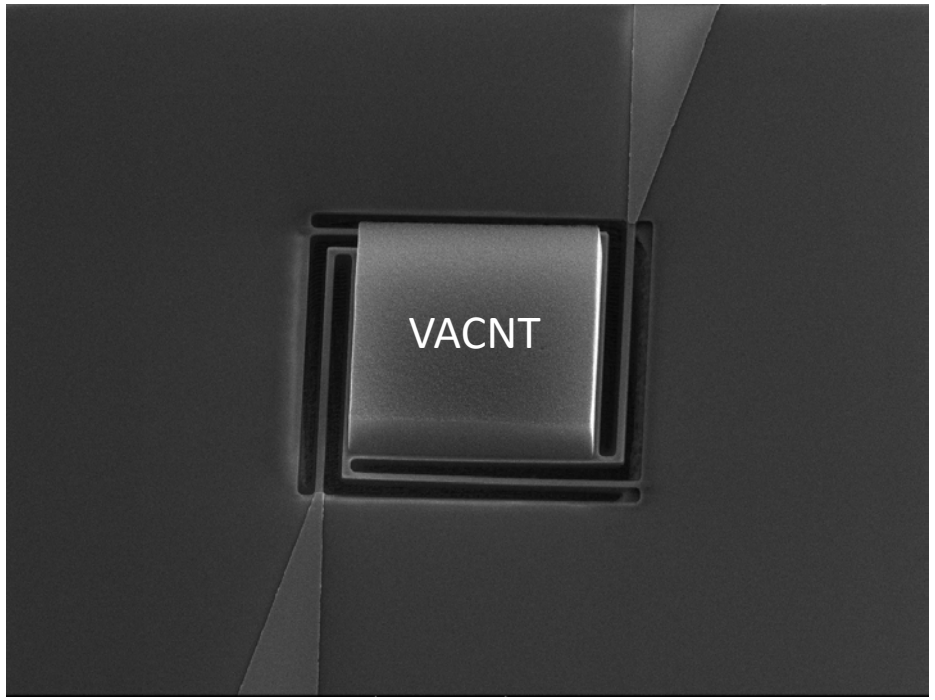
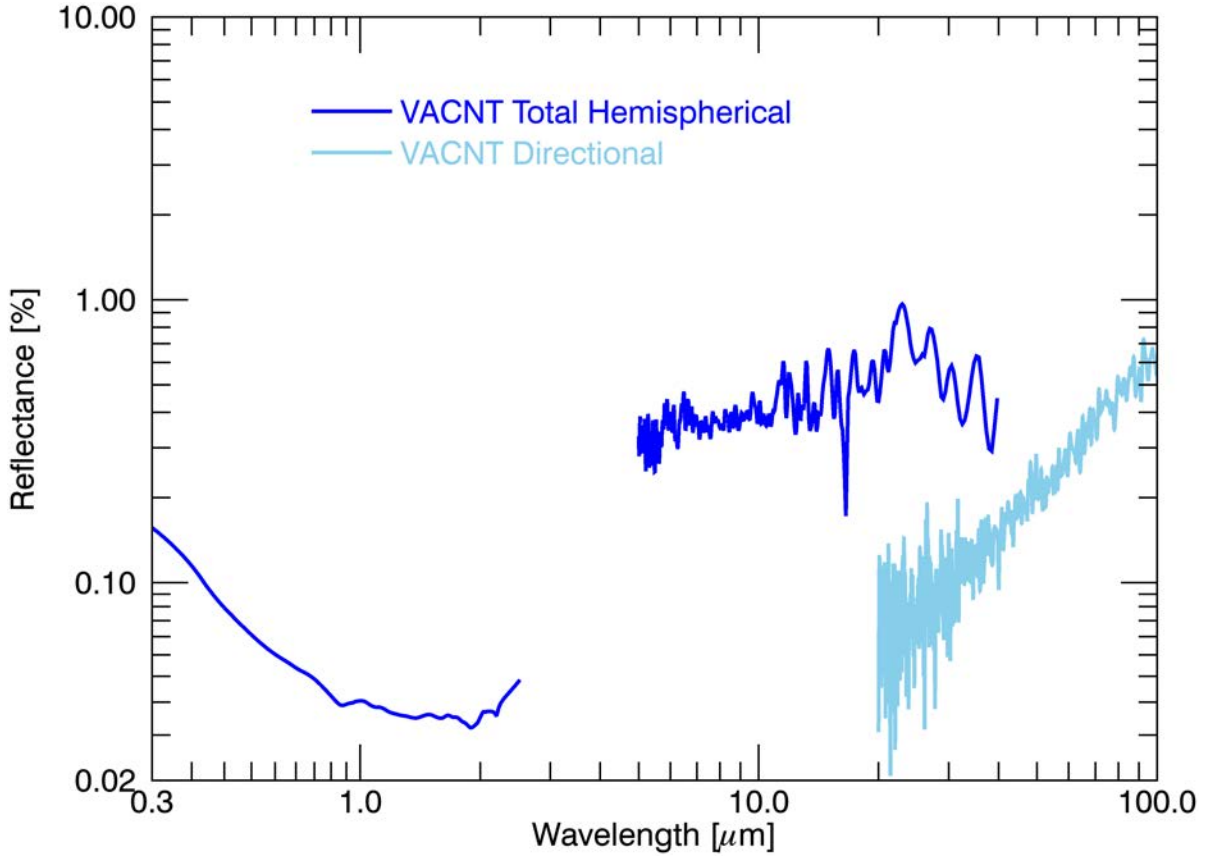
Measurements of Earth's outgoing broadband radiation are critical to determining Earth's radiation budget

- High accuracy measurements are very challenging:
  - Broadband wavelength range of ~200 nm to 100 um (spectrally flat absorber)
  - Spatial resolution of ~1 km to monitor cloud variability (detector array)
  - Absolute radiometric accuracy of <1% over mission life (absolute detector)
  - High data rate for good ground coverage from LEO (fast response time)

Detector technology developed under BABAR takes three-fold approach: (1) incorporate broadband VACNT absorber

- VACNT absorber provides >99% absorptance from 200 nm to 100 um





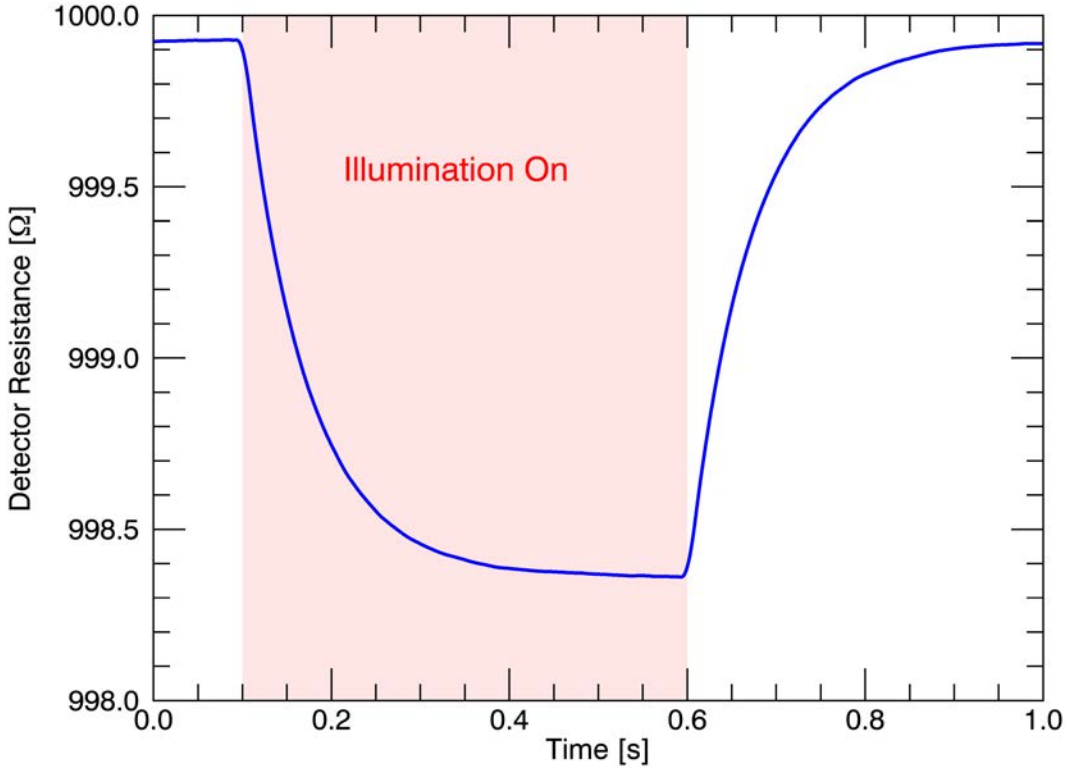
Detector technology developed under BABAR takes three-fold approach: (2) fabricate an array of detector elements

- 32-element array for high spatial resolution and good ground coverage

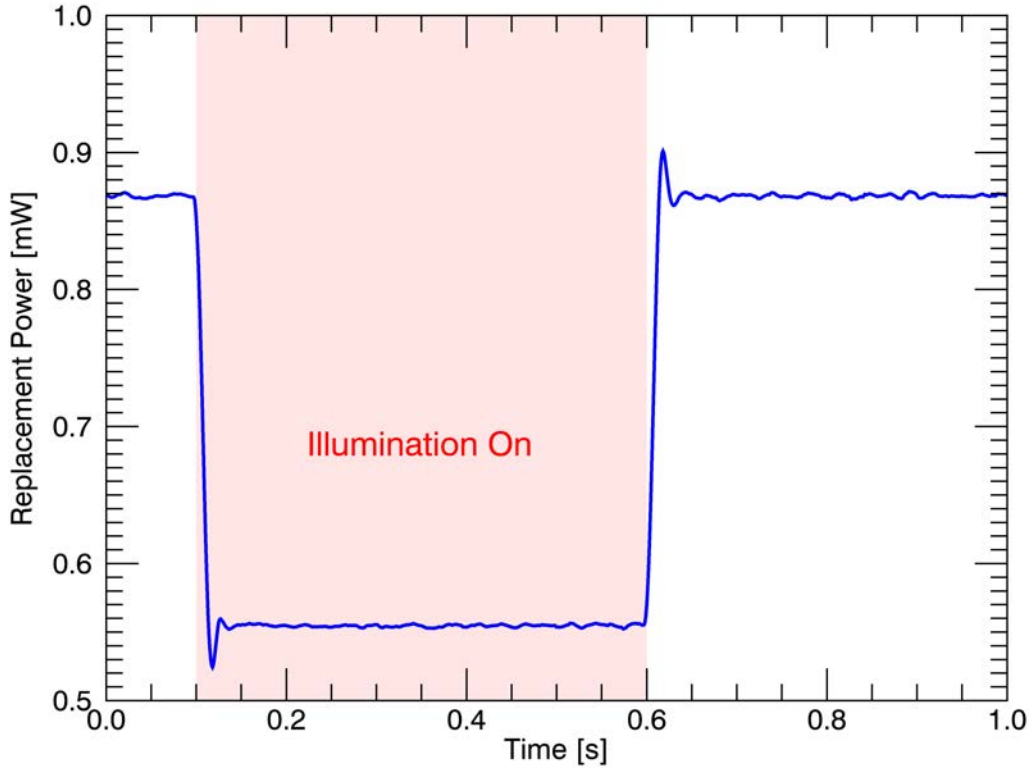
Detector technology developed under BABAR takes three-fold approach: (3) operate detector elements in closed-loop

- Absolute accuracy and fast response achieved via ESR operation

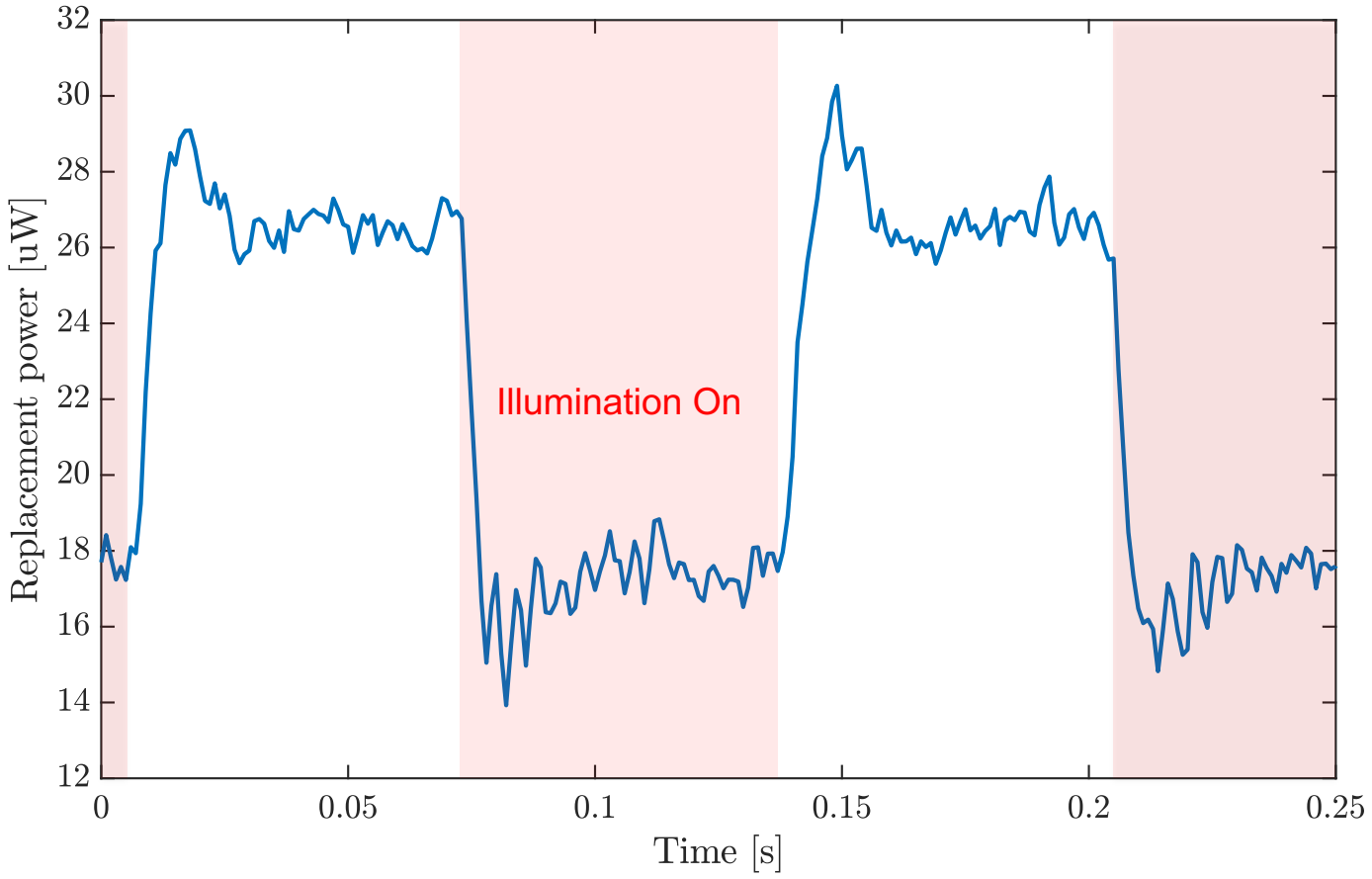
Open loop (bolometer)



Closed loop (ESR)



Closed-loop response of a single detector element to incident light modulated at 7.6 Hz



Summary and next steps

- Developed a 32-element linear array of absolute radiometers (BABAR)
  - VACNT absorber provides >99% absorptance from 200 nm to 100 um
  - Closed-loop control provides fast response time and simplifies calibration
  - High radiometric accuracy on each pixel
  - Room temperature, absolute detector allows for low SWaP

- Recently awarded BABAR-ERI IIP will develop cubesat instrument
  - Image Earth's outgoing broadband shortwave and longwave radiation